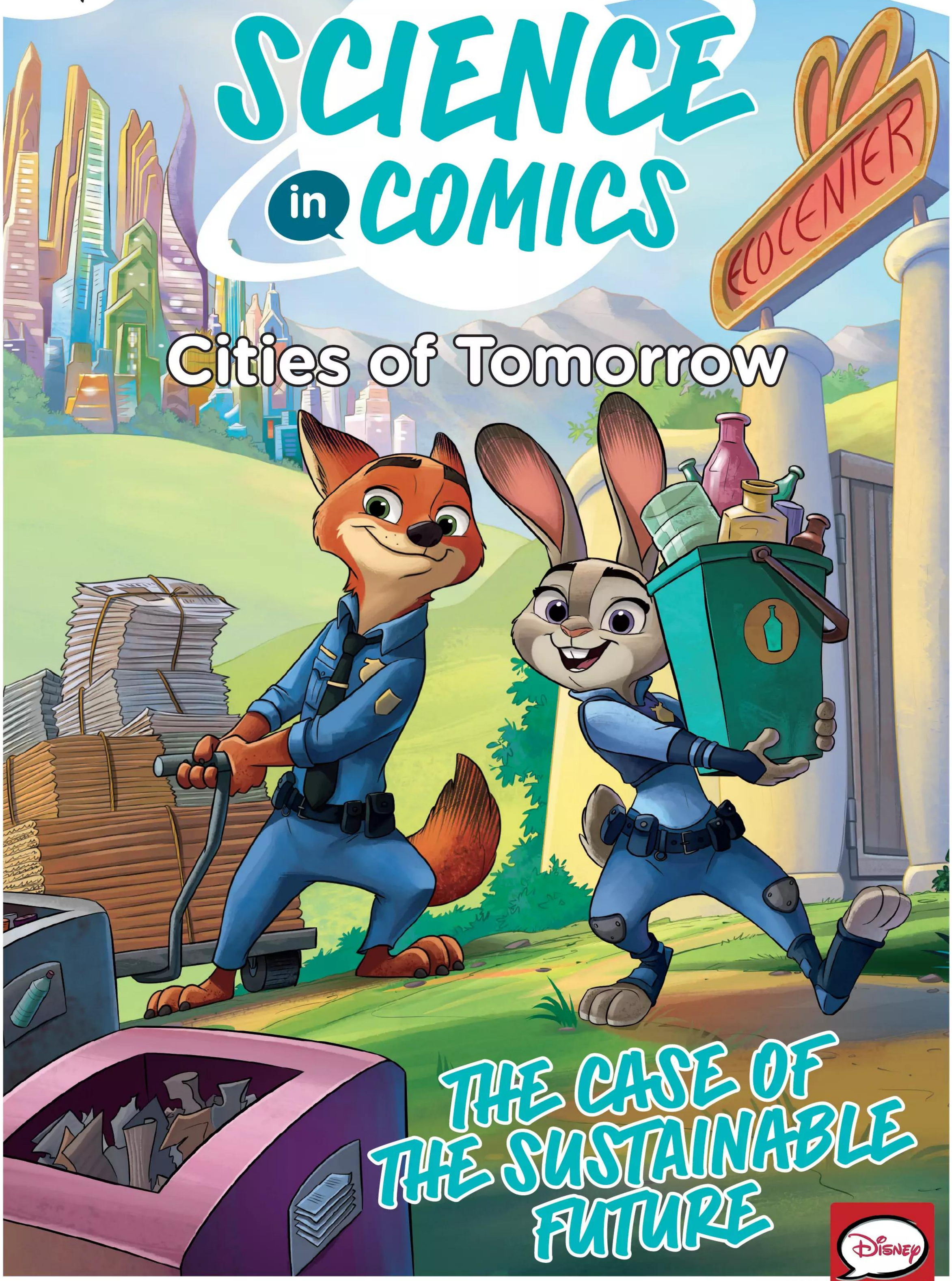
SCIENCE in COMICS

Cities of Tomorrow



THE CASE OF THE SUSTAINABLE FUTURE

Disney COMICS

Disney **Science in Comics** is a series of comics titles designed to build a sound knowledge base for kids 8–12 years old, on science themes related to features and secrets of the world around us.

In this fast-changing world, the future of cities will greatly impact the future of life on Earth. Science and Technologies can help developing sustainable cities able to meet the social, economic, and environmental goals of the United Nations 2030 Agenda for Sustainable Development. This book shows you how.

CITIES OF TOMORROW: *THE CASE OF THE SUSTAINABLE FUTURE*

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Meet the heroes and new villains of Zootopia

JUDY

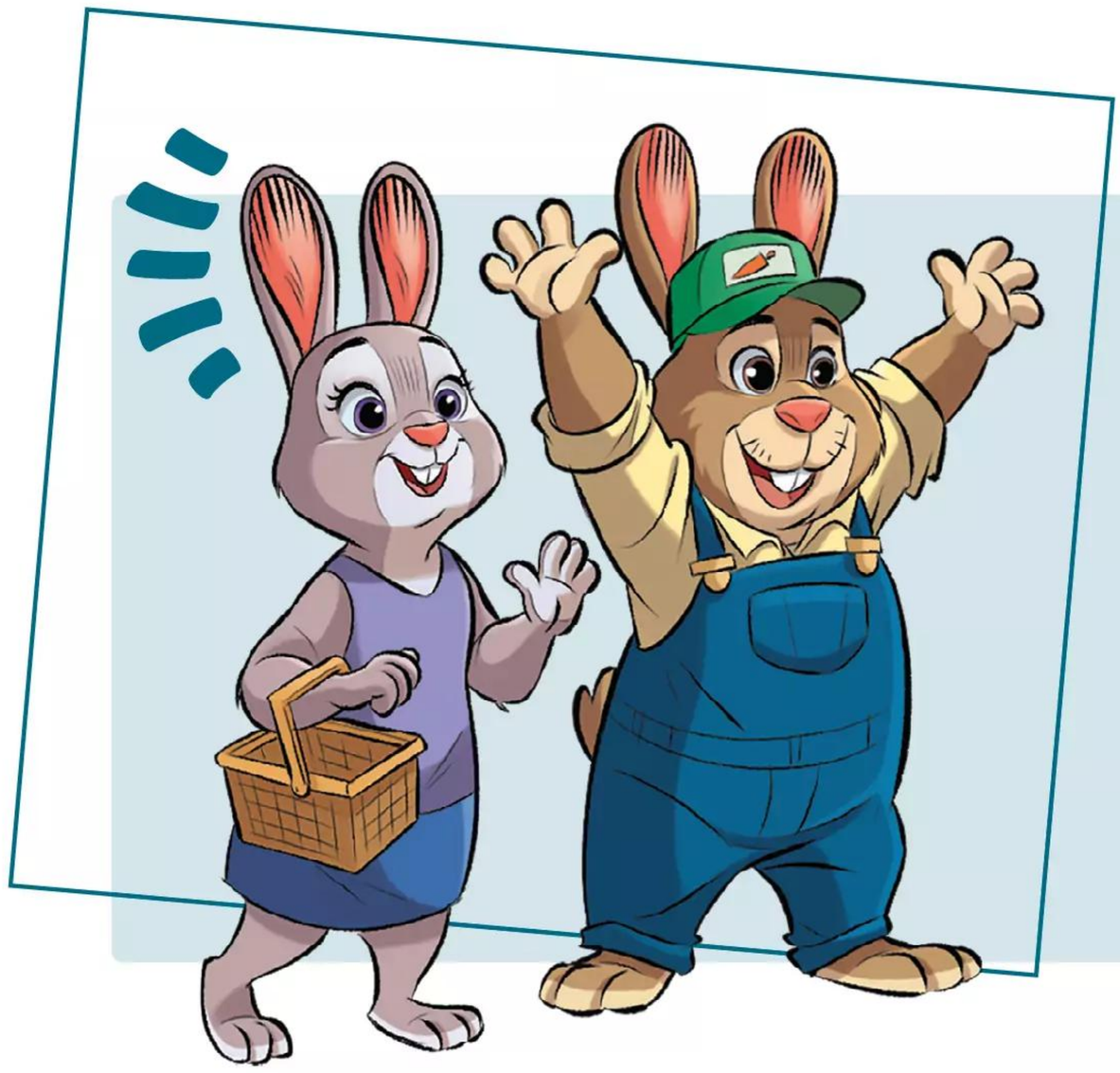
Officer Judy Hopps is **strongly idealistic and independent**. Since her childhood in the countryside of Zootopia, she has pursued the dream of becoming a police officer, with the goal of making the world a better place. And that dream became true when she succeeded in becoming **Zootopia Police Department's first rabbit officer**.

NICK

Formerly a fox **con artist** with street smarts, Officer Nick Wilde met Judy during her first police investigation. After she helped him **change his view of himself**, he has become her partner in the Zootopia Police Department, and her **best friend**.

CHIEF BOGO

Police Chief Bogo is a **strict and no-nonsense** cape buffalo. Although at first he was rather skeptical of the only rabbit allowed in the Zootopia Police Department, he ended up **valuing Judy and accepting both her and Nick** as equals to all other agents in the force.



BONNIE & STU

Judy's parents, Bonnie and Stu, live in the rural neighborhood of Bunny-burrow, where they tend to **their carrots fields** as well as to a lot of young bunnies. When Judy left their home for the city, Daddy Stu was not very happy, **fearing that Zootopia was too dangerous** for his daughter. Since then, however, he has mellowed, **accepting her move and new lifestyle**.

Yax is **a free-spirited yak** who works at a naturist center in Zootopia. Despite his carefree and somewhat laid-back nature can make him look very oblivious of things, he has an **exceptional memory** and proves to be **an excellent source of information** for Judy and Nick.

MR. SKUNKINGTON AND HIS HENCHMEN

Dottie, Rings, and Stripe are a trio of nocturnal animals in the employ of the **Skunkington Disposal Company**. Dottie, the masked polecat, is the company's truck driver, but she's also the undisputed leader of the group, which includes raccoon Rings, the muscle, and slow-witted badger Stripe. All three are the henchmen of **Mr. Skunkington**, a seemingly respectable businessman who is making his fortune out of yard debris disposal.

BACK HOME

Oh, I'm really nervous!

Hardly surprising: you bunnies are so emotional.

BUNNY BURROW

It's just that it's the first time I've been home in months.

And the first time you've taken a **guest** with you!

A *fox* guest, no less!

Oh, you know my folks aren't prejudiced against foxes anymore, Nick!

In fact, they can't wait to have you with them to celebrate All Carrots' Eve!

Yeah, sure. They'll probably want to take a good look at your new cop partner to see if you can really trust him!

There's nothing to be nervous about.

Nervous? Me? No, it's just... um...

Do you think... your family will like me?

Why wouldn't they? You're my colleague and my best friend!

As your best friend, Carrots, can I ask you a question?

Yes?

How come everything always revolves around carrots with you bunnies?

That's not true! Rabbits are interested in other things, too!

Oh, so it's just a coincidence that your **Bunnyburrow** celebration is called **All Carrots' Eve**, is it?

Of course! We have lots of other celebrations in my town, I'll have you know!

Oh, yes? Such as... ?

Well... um... there's the **Carrot Sowing Feast**, the election of **Miss and Mister Carrot**, the **Carrot Festival**, **Carrotween**...

We're here!

SWISSSS

Come on, take it easy. It'll just be a small thing with a few family members.

Sigh. All right, here goes nothing!

You lot have a weird idea of "small" and "few"!

WELCOME HOME JUDY! AND NICK

Hey, Judy! We're over here!

I see that, Dad. It's hard to miss you lot.

Mom, Dad... meet my partner in crime fighting!

Pleased to-- Ooof!

SPAT

Welcome, **Rick**! Any friend of Judy's is a friend of ours!

It's Nick, Stu!

Hey, I know. I was joking!

HAPPY ALL CARROTS' EVE!
Are you a cop like my sis?
Can I see your badge?
Uh... Um...
It sure feels good to be back home, even if it's just for a few days!
Life here is certainly less hectic than in the big city!
But don't you ever miss Bunnyburrow?
Well... you know, in Zootopia there are always lots of big changes, Mom. Especially now, with the new mayor.
Not to mention less dangerous!
Daaaad...

Here, on the other hand, everything's always the same! Although I must admit the old, immobile, always-the-same Bunnyburrow is comforting.

Oh, I wouldn't be so sure!

What do you mean?

I mean that many others here have followed your example and moved to Zootopia, seeking new job opportunities!

Well, I'm happy about that! I think that's... a good thing, isn't it?

Hmm... if you consider leaving the great outdoors for a studio in an anonymous apartment building "good."

Please don't start that again, Stu!

As a matter of fact, Judy, the reverse is also happening!

You mean people are leaving the city to come here? Actually, there are some new faces around...

Yep! Young people, mostly! All pretty decent folks, I must say!

They say they came to live here because of the new opportunities life in the countryside offers. Who would've thought it, hey?

Da-a-aad... I already have a life. As a Zootopia cop!

Stop nagging your daughter, dear. Let's go get some groceries for tomorrow's lunch!

Come with us, Nick!

Huh... Gladly!

RE GROCERY SALE

My, these don't look good today, Mabel!

Don't get me started, Bonnie! All my produce has been like this for days!

Maybe try that store... ?

Heavens, no! They sell all packaged stuff there that comes from who knows where! We prefer to buy local products and avoid unnecessary waste.

At least we don't have to worry about carrots!

You know, Mom and Dad have the largest carrot farm in Bunnyburrow!

Oh, not anymore, my dear!

What do you mean?

We've given up **intensive farming!**

You see, Judy, your father and I started keeping ourselves more informed, and we discovered that always growing the same product isn't good!

Yeah! We now know that **monocultures** cause problems!

Um... city guy here. What are we talking about?

Only ever growing a **single product**, Nick, is harmful in the long run!

In the long-term, growing the same vegetables in the same field areas over and over again **weakens the crops**, exposing them more to disease!

And a single crop always uses up the same specific elements, eventually **draining them from the soil**, which is made of minerals, water, and organic matter.

And when chemicals called **pesticides** are used to drive harmful insects away from the crops, that **poisons the soil**... which is bad for the whole environment!

So, no more carrots?

Oh no, we still have those!

We just decided to focus on **variety**! Now we grow lots of different types, plus we give space to other crops, too. You'll see!

Later, on the porch...

Looks like your quiet little town isn't quite so unchanging after all.

You're right. I guess I'll just have to get used to all these new things.

After all, sounds like they're all changes for the better, right?

That's the spirit, Carrots!

CONTINUES ON PAGE 21

THE PLANET'S RESOURCES

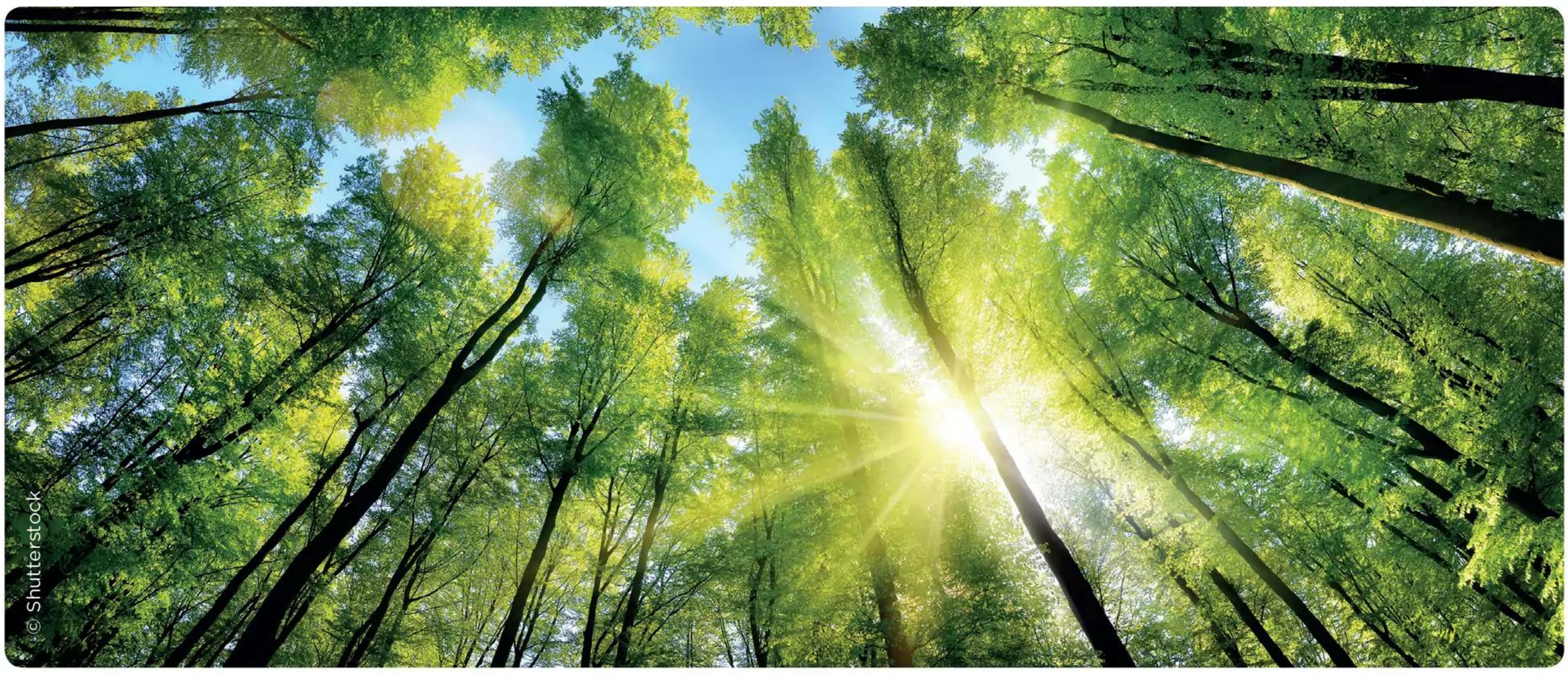
- Planetary boundaries
- Ecological footprint
- Urbanization
- What will happen in the future?

Planetary boundaries

WHAT DOES EARTH GIVE US?

Earth is rich in **natural resources**, which can be found in the ground and forests, in the sea and freshwater, and even in the air! Natural resources are essential for some very important processes. For instance, **pollination**—the transfer of pollen that allows plants to reproduce—relies on wind, bees, and other animals. Climate is also affected by natural resources; for example, plants ensure that Earth's temperature doesn't rise too much. Basically, natural resources are necessary for the planet to function properly. However, we must be careful because they are **limited**, meaning they can run out. That's why it's important to take good care of such resources and not to waste them.

When there's too much of a gas called carbon dioxide in the air, the temperature rises. Plants are very important since they absorb it, thus balancing the temperature values.



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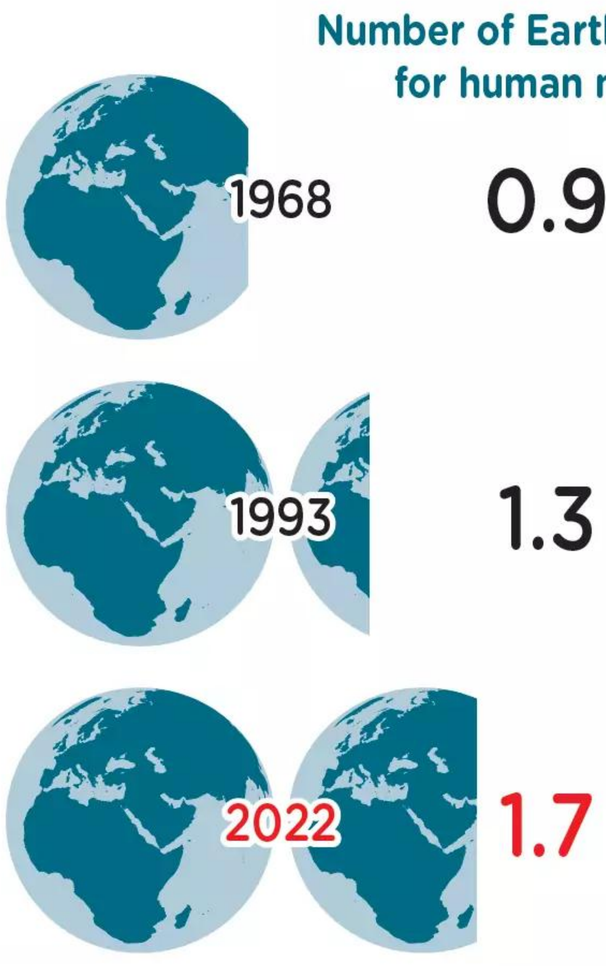
Ecological footprint

USING UP NATURAL RESOURCES

Earth has limited natural resources, which are used by both the planet itself and the life forms that live there. However, humans use more than their share of resources, leaving the planet with less than it needs and causing some of its processes to function less effectively. But how do we know how much of the resources we can use? By calculating our **ecological footprint**, which measures how much humans take from nature by comparing the resources that they need to live with those that nature can produce.

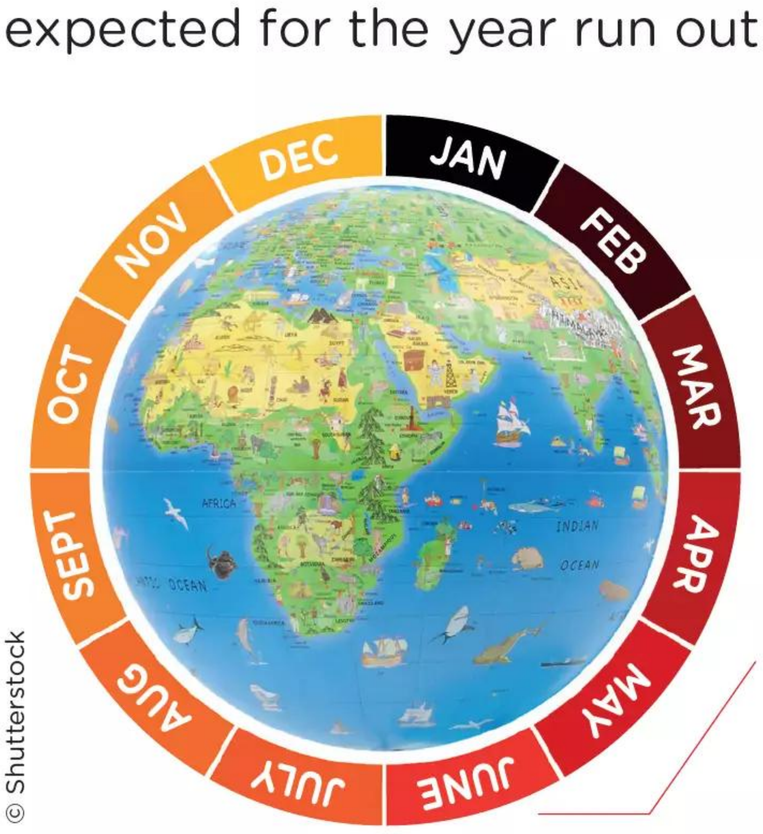


Over time, our ecological deficit has increased. Nowadays, we need one and a half Earths to meet human consumption, but we have only one!

When humans consume too much of the natural resources, or consume them too fast, an **ecological deficit** is created, meaning there's a shortage of resources: we're using more than Earth can provide.

IN DEBT TO EARTH

Earth Overshoot Day marks the date when the natural resources expected for the year run out. From that day on, humans' ecological deficit increases. It's very important and still possible to push forward Earth Overshoot Day by setting rules to reduce the human consumption of natural resources. For example, establishing a maximum number of trees that can be cut down to convert a forest into a farmland or into a new city district. However, in order for these limits to work, **everyone must respect them!**



July 29: Earth Overshoot Day 2021

In 2021, Earth Overshoot Day was identified as July 29: in just seven months, humans had consumed all the resources that Earth would produce over the whole year. And this day gets earlier each year!

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Urbanization

EVERYONE IN THE CITY

Today, over half the world's population live in cities. This trend is called **urbanization**, and it's continuing to spread all over the world, particularly in Africa and Asia. Most people move to the city to seek work, get better health care and education, and have greater access to social services and enhanced opportunities for cultural and political participation. But everyone living closer together **increases the need for natural resources** , thus requiring their careful management so everyone can benefit from them. And it can also cause more air pollution and noise! Additionally, with more people living in the same city, **more waste is produced** in the same place, and managing it can become much more complicated.

Because cities are growing so fast, it is even more essential to respect Earth and its resources, which is happening more often now in modern cities. The city and the countryside may appear to have little in common, but today cities are increasingly incorporating elements typical of the countryside. For example, in addition to building a growing number of houses in green areas on the outskirts, more and more parks, playgrounds, and gardens are being added to more central neighborhoods. What's more, agriculture is increasingly entering urban areas, with city farms, urban gardens, and **vertical farms**, which are greenhouses arranged in different levels one over the other.

Growing fruit and vegetables in vertical farms housed in city buildings may waste fewer natural resources like water and soil.

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What will happen in the future?

SUSTAINABLE DEVELOPMENT

Respecting limits on the use of available natural resources is a huge challenge for humanity. To achieve **sustainable development**, we must find a way of producing and consuming that avoids wasting resources so there is enough for everyone, including future generations. This can be accomplished with the help of new scientific and technological discoveries that maximize what's available today. For instance, advances in the energy field have allowed us to produce more energy while polluting less, thus protecting people's and planet's health. Since humans can't live without clean air, water to drink, and plants to eat, sustainability is at the base of people's general well-being.

THE 2030 AGENDA

In 2015, the governments of the 193 member countries of the United Nations (UN) created the **2030 Agenda for Sustainable Development**. It consists of 17 very important goals, including no poverty, zero hunger, and climate action, to be achieved by 2030.

Number 11 highlights the importance of making our cities and communities more sustainable, for example, by ensuring access to adequate, safe, and affordable housing and basic services for all.

The Global Goals, agreed to by world leaders, aim to build a better world by 2030, and we can all play our part, for example, by walking or taking the bus to school, rather than relying on the family car.

POPS HOPPS'S CROPS

The next day...

HAPPY ALL CARROTS' EVE, EVERYBODY!

Uh... cheers!

Gee, Mr. Hopps! You certainly know how to grow your veg!

This is nothing! Later, I'll show you and Judy our new crops!

Sure, Mom and Dad! We'd be delighted to see your environmentally sustainable solutions... Right, Nick?

Uh-huh... Delighted, sure!

And so, after the lunch...

There's a lot more variety now!

Told ya, Jude the dude!

Growing a single product exposes it to too many risks. If a vegetable is attacked by diseases or parasites, these can spread to the whole plantation in the blink of an eye... and then it's goodbye harvest!

Instead, diversifying crops makes it easier to **contain any epidemics** and act in time to treat the crops!

And there's more, dear. We've stopped using **pesticides**! Instead, we have turned to biocontrol, which means using helpful insects to fight harmful ones!

This way, everything becomes more natural and therefore more stable and, as you can see, **teeming with life**! For example, we now have a lot of very useful **pollinating insects**!

Yep, I see that!

And what about the carrots?

No more identical carrots!

We now grow all kinds, instead of just a single type!

We have quite a variety: Little Paws, King Roots, Tendersweets, Fluffytails, Big Harveys, Moon Hares, as well as the white, red, rainbow, and yellow varieties... all together!

Wow, there are even **purple** ones!

Those, lad, are the authentic **original carrots** that my great-grandmother grew! A native and almost forgotten species... incredibly hardy, much more than the modern varieties!

Which means they are less vulnerable to disease! And this is what makes them particularly suitable for our **organic farming**!

Wow, Dad. I'm amazed! You've become a carrotologist!

Well, you know, your mom and me had to adapt to the times.

Not like that troublemaker, Ned O'Hara, with his large estate just next door!

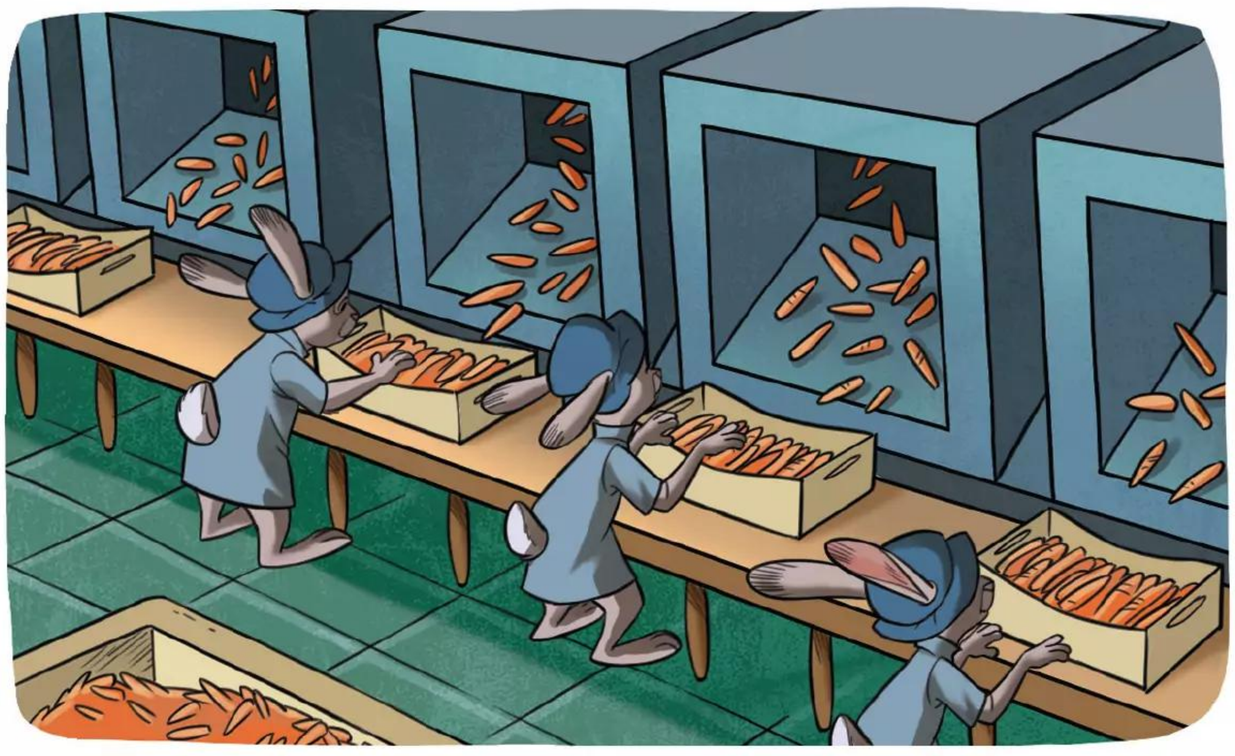
Shh, Stu, don't start that again! After all, he's modernized, too!

Pfft! He's **automated** all the processing in order to grow a **single type** of carrot, **only** selecting the identical ones! And then he sends them to places reeeaaally far away from here.

And he harvests them early, too early, so that they ripen during the journey.

So, as well as being less tasty, between the **fuel** for the trucks, the **plastic** packaging, and the **refrigeration**, carrots produced like this cause a lot of **pollution**.

In exchange for a **more expensive but mediocre** product! The exact opposite of what we're doing here!



=Munch= And you can tell the difference!

And... what do you call this **weird carrot here?**

GASP!

This carrot is **really sick!**

I don't think it's a disease, Stu! These tomatoes are affected in the same way!

They seem to be contaminated by something... all of them!

Half of the crop is ruined!

They look the same as Mabel's vegetables! Heaven help us!

I gather that this is all pretty unusual?

Oh, Nick, this may very well be a tragedy! If the whole crop is unhealthy, my family's entire livelihood is blown!

I **must** do something about it!

Huh, Carrots?

=Pant= Hey, Judy, what's going on?

It's just... I didn't think I would find trouble right here in my hometown!

We have to do something, Nick! What could possibly be happening to my family's crops?

Erm... I don't know what to tell you. I have street smarts, not countryside ones!

It's the water's fault!

That's Mr. Dammer, the owner of the watermill...

It's the water, I tell you! It's been getting dirtier for days!

Someone is poisoning it, and everything around here is affected!

But who would do such a thing?

Oh, for a while now there's been some strange comings and goings around here at night... Strange trucks near the covered bridge, dumping stuff in the river, if you catch my drift...

"Strange trucks"?

Unfortunately, no one believes me!

Hmmm...

It's settled. Tonight, we'll stake out the river!

Huh?

Later that night...

I really don't know what's got into you, Carrots! Weren't we supposed to come here on vacation?

I want to know what's going on with Bunnyburrow's crops, Nick!

Don't you?

Uh, sure, sure. It's just that I don't think your miller's tales are all that reliable--

ROAR

What were you saying?

CONTINUES ON PAGE 35

MONOCULTURES AND INTENSIVE FARMING

- The beginning of farming
- GMOs in farming
- Local farming

The beginning of farming

THE FIRST SEED

The development of agriculture, about 12,000 years ago, changed the way humans lived. They switched from nomadic hunter-gatherer lifestyles to permanent settlements and farming, and started planting seeds in favorable locations in order to grow them and eat plants. This is how rural communities were formed: groups of farmers who learned how to choose and use the best seeds. They also taught what they knew to their children, who in turn discovered other seeds, and so on, allowing humans to grow many different species of plants. And the more the species differ from each other, the higher the chances that some of them will have the characteristics to adjust to and survive changes in the environment. This variety of plant and animal species is part of **biodiversity**.

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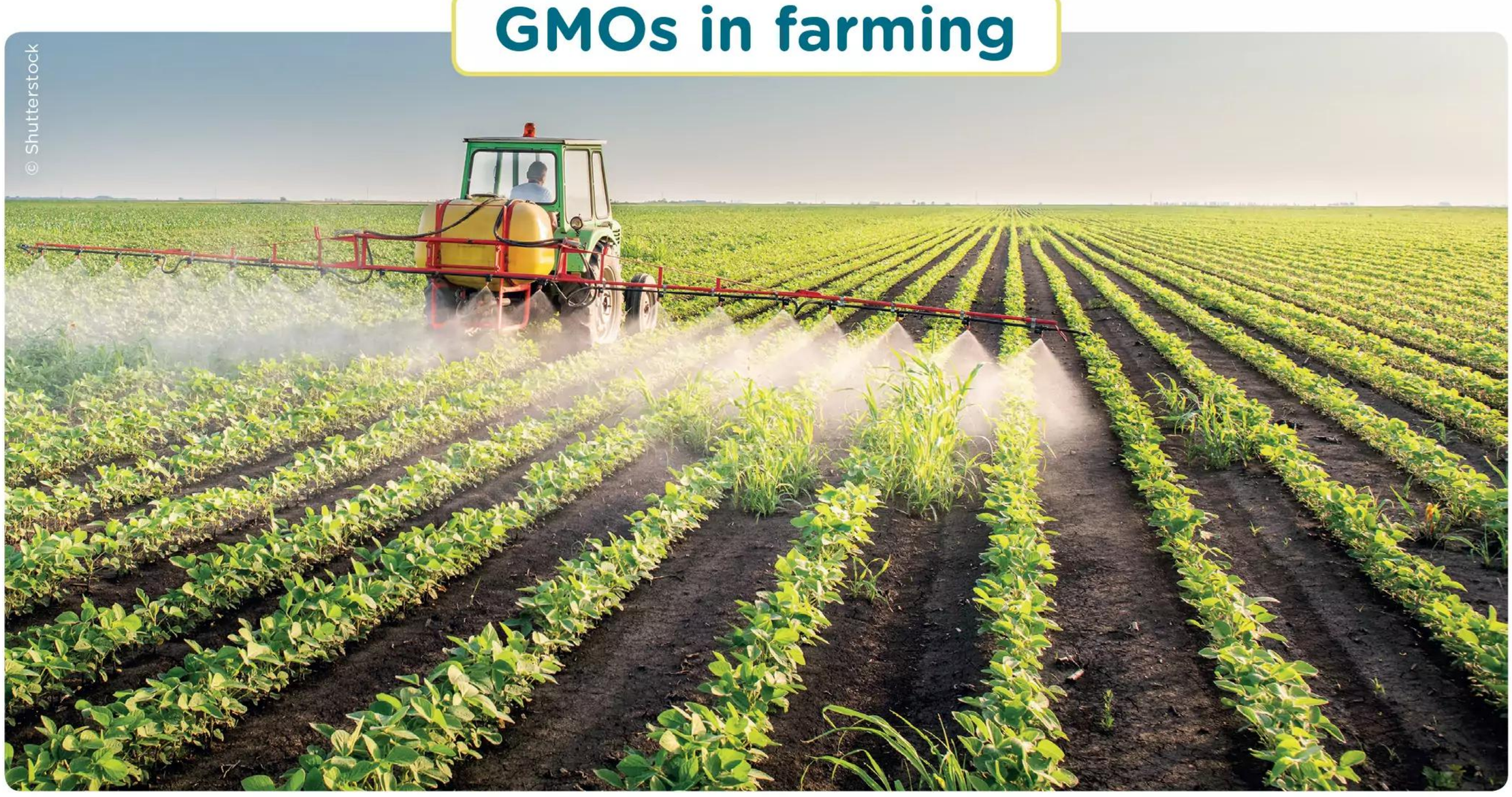
Biodiversity doesn't refer just to the variety of living organisms, but also to that of the environments they live in.

GMOs in farming



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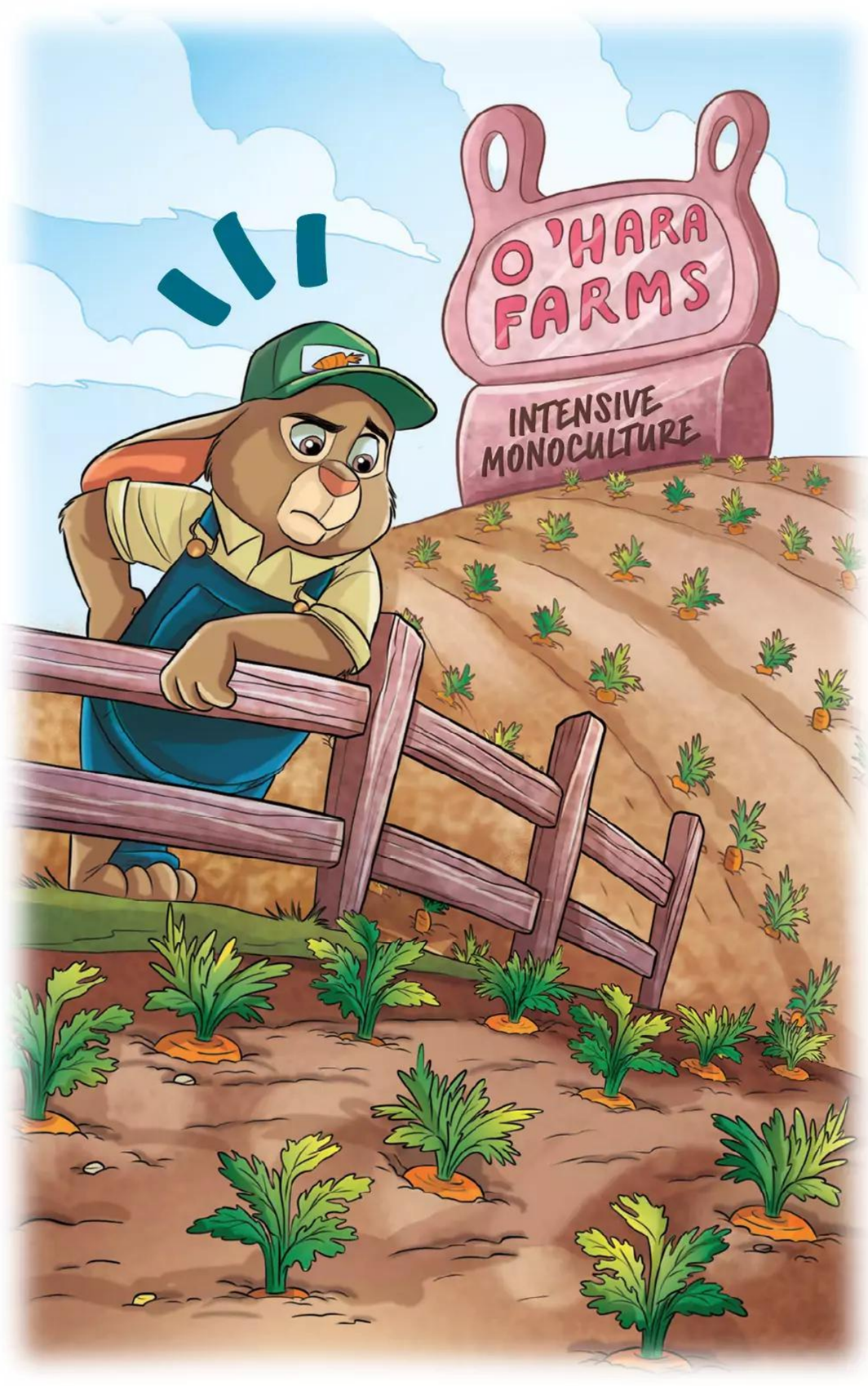
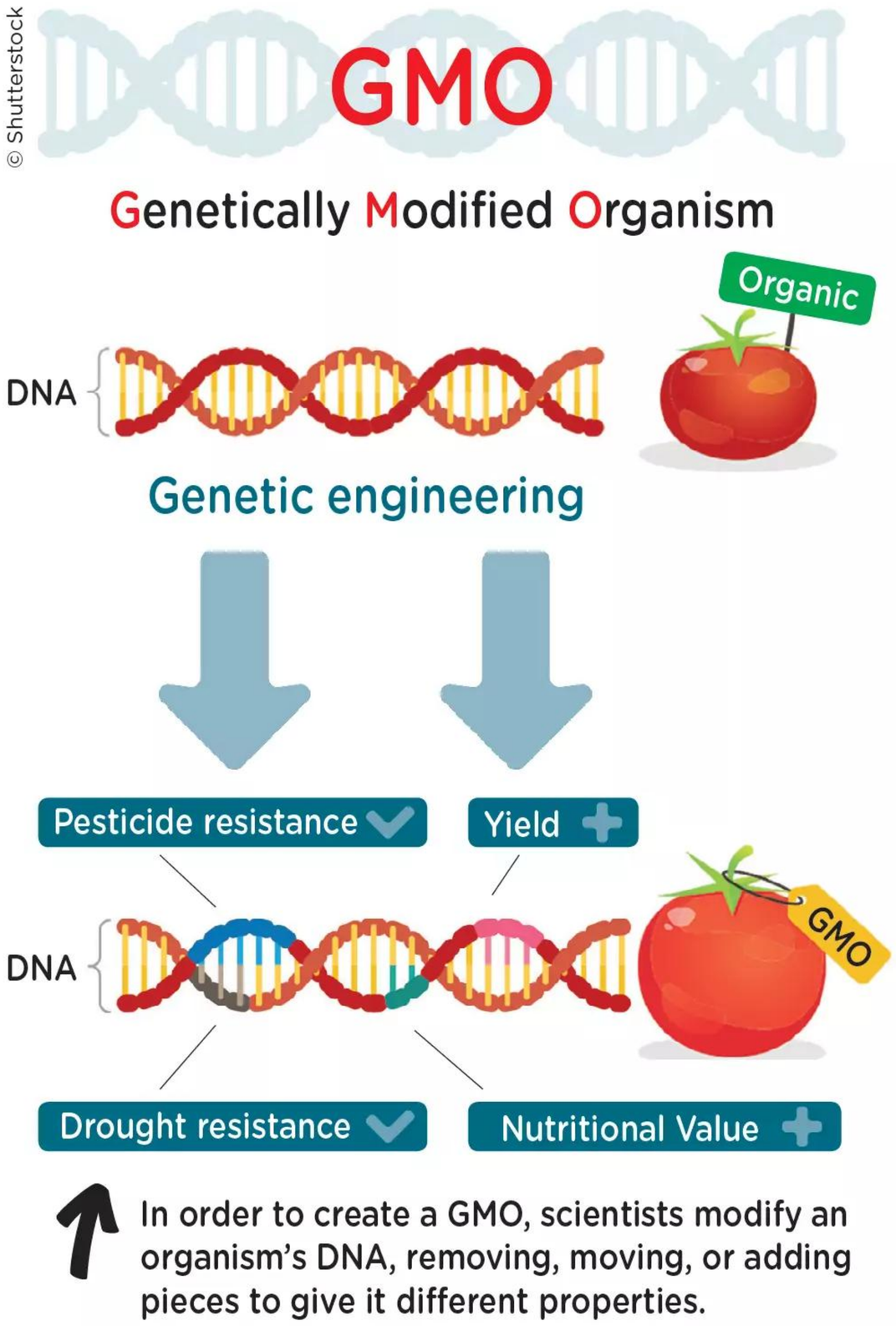
WHAT IS MONOCULTURE?

The purpose of agriculture is to farm the land and obtain food. A great variety of plants can be grown one after the other in the same soil, being alternated throughout the year, but it's also possible to plant just a few species, or even a single one. This latter type of farming is called **monoculture**. It is often done intensively, meaning farmers exploit the land to the fullest to grow as many plants as possible within a limited area. Unfortunately, growing just one or a few types of seeds on a large scale takes a lot of space and resources away from other plant species, and can cause their disappearance, as well as that of the animals that rely on those plants to survive. Furthermore, intensive farming deprives the soil of its elements, requiring the need to use **larger quantities of chemicals** like fertilizers to add nutrients, and pesticides to tackle plant diseases, which can pollute the soil and water.

As more land is farmed as monocultures, the number of natural environments that are home to a diversity of plants and animals decreases.





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In order to create a GMO, scientists modify an organism's DNA, removing, moving, or adding pieces to give it different properties.

WHAT ARE GMOS?

Technological advances have allowed more crops to be grown using fewer chemicals. **GMOs** are one example. They are genetically modified organisms, meaning that changes have been made to their **DNA**, a molecule that carries an organism's **genetic blueprint**. In other words, DNA contains all the information required to build and maintain an organism. These changes cause GMO plants to produce slightly different fruits from the ones found in nature. They might be more resistent to diseases or even ripen more slowly so less harvest is wasted. GMOs are considered safe to eat, but longer-term effects on humans' health still need to be fully studied.

TOGETHER FOR BIODIVERSITY

GMOs can be more enduring than organisms found in nature. As such, they are widely used in intensive monocultures because they allow the production of large amounts of food, which will be enough to meet the needs of the current global population. What's more, certain plants are also modified to withstand heat so the same land can continue to be farmed even when the climate changes. However, these new crops can lead to the disappearance of **traditional seeds**, which are much more delicate and difficult to grow than genetically modified ones.

Along with the traditional seeds, those who grow them could also disappear: the small communities of farmers who have handed down a form of agriculture where different crops are alternated. So what can we do to avoid losing biodiversity? We can use GMO seeds while also making sure not to completely eliminate traditional ones.

© Science Photo Library

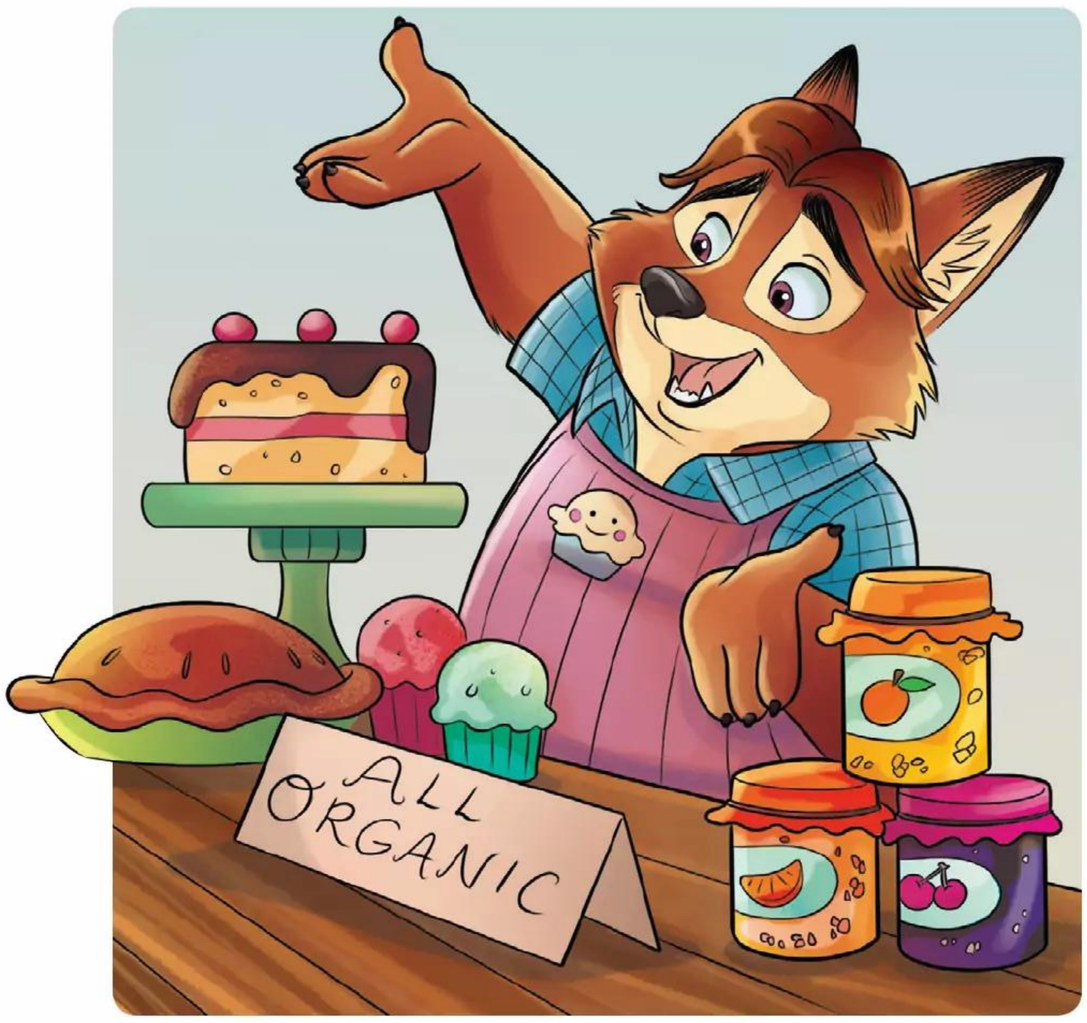
GMOs can also have health benefits: genetically modified Golden Rice is a type of rice that is more nutritious for humans than standard white rice.

Local farming

SUSTAINABLE PRODUCTION

These days, farmers face a very important challenge: to produce food while respecting the planet and its biodiversity. This is possible by using a sustainable form of production, that is, by producing food in a way that respects nature more than farming practices generally do. Small family-run farms tend to do this more often, because they know well the land they farm and hand down their experience from parent to child. However, in order to make a difference, it is important for everyone, especially large farms, to switch to sustainable forms of production.

Indeed, farmers should always respect the land and know when it should "rest" or when new seeds can be planted. **Organic**—meaning "only natural"—farming methods should be used as often as possible to allow the soil to become more fertile and to control parasites. Finally, farmers should waste as little of the crop as possible, for example, by using the parts of the plants that aren't eaten to make fertilizer. Such good practices help reduce waste and should be put in place by all farms to preserve the environment and its biodiversity.



One of the benefits of family farming is the opportunity to hand down knowledge from parent to child. This can lead new generations to farm more productively and waste fewer resources.

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WHO'S DUMPING WHAT?

VRROOOMM

Okay, I admit it, you were right! Something shady is going on!

That's for sure! What's a **dump truck** doing out here... and in the middle of the night?

KA-KLUNK

RUMBLEEEE

SPLASSH

Whoops, guess there's your answer!

They're dumping rubble into the river!

I bet it's totally illegal.

You can say that again!

HEY, YOU!

I'm Agent Hopps of the ZPD! **Everybody in there, freeze!**

Darn! There are cops?!

Never seen any 'round here before!

The boss promised us there wouldn't be a living soul on the river at night!

And yet, **Stripe**, those sure aren't ghosts, are they?

Don't you dare move an inch, **Rings**, you fool! The boss told us not to attract attention!

I can change that, **Dottie!**

Okay, okay, there's no need to shout.

So what do we do?

THIS!

VROOOO

HEY!

JUDY!!!

VROOOOOOOM!

Watch out!

Oof!

You okay?

I'm fine... `but they're getting away!

Without us managing to identify them!

If nothing else...

... we now know **what's** poisoning the river water... and consequently, Bunnyburrow's crops! **Illegal dumping of toxic materials!**

Yeah, but we don't know **who's** doing it yet!

Unfortunately, the license plate was unreadable! And there was no writing on the truck to give us any clues!

More **conveniently** than **unfortunately**, I'd say! We don't have a shred of a trail that could help u--**hey!**

It fell off the speeding truck before it could be dumped in the river!

It looks like... a bottle?

As the sun rises over the horizon...

That's our only clue. Be careful!

Relax, Carrots! Anyway, I'm not so sure this bottle can tell us much!

Though I must admit, the more I look at it, the more it reminds me of something... something from my childhood...

Hey, there! If it isn't Judy Hopps!

Uh, hi, Gideon!

Pfft... As if we got a wink of sleep!

Say, you sure got up early today! How are you?

The truth is it's been a long night, Gideon! And you? Everything **okay** with the cakes?

Oh, for sure!

As a matter of fact, I'm here to dispose of my business's by-products!

So you're sorting your waste? That's great!

Ah, I do much more than just sort it now! For example, that's the leftover **peels** of the citrus fruits I use in my fruitcakes!

Uh-huh? And what do you do with them?

I used to throw them away. Now I **resell** them!

You mean there is a way **to make money** off of that stuff?

You see, we usually only use the pulp of an **orange** or **tangerine**, and throw away the peel and seeds! But it's recently been discovered that even the scraps can be reused, for example, by turning them into a **cellulose-based** fiber similar to silk!

Isn't cellulose the **main component** in the structure of **plants**?

Exactly! You can use it to create fabrics that are **biodegradable!**

Which means once they've worn out they can dissolve in the environment!

This way, we not only reduce waste, we also produce less of it to pollute the environment! And that's not all, by the way!

In these jars is the oil I used to fry my funnel cakes.

I think it was actually your folks who explained it to me: oil that's been used for frying **can't be thrown away**, not down the drains or on the ground!

Dumping oil in the environment is very serious. The oil covers everything with a film that prevents oxygen from circulating, both in water and on land!

So I bring it here, where it's collected to be reused to produce something else useful, such as **soap, biodiesel, lubricants, biogas, and pitch for roads!**

In other words, Judy, most waste can be used again, with materials and by-products staying in use longer and thus reducing the production of other waste.

And speaking of roads: even the tricycle I use to bring my rubbish here is made of **aluminum** made from **recycled cans!**

It's all very interesting, Gideon, but...

I understand, but we have a lot to do...

POP!

DID IT!

I got my finger free, finally!

KLUNK

VRRRMMM

About time! I noticed you've been quite busy with that bottle...

Heh... I was just, err... checking it for clues?

SHFFF

KA-KLUNK

Glad to hear it, because I was under the impression that you were fumbling with what may be the only piece of evidence available.

Heh. Don't worry, Carrots!

VROOOMM!

Erm, people. Speaking of your bottle...

Where did it go?

CONTINUES ON PAGE 49

THE WORLD OF WASTE

- Municipal and industrial waste
- Landfills
- Collecting and recycling
- Waste-to-energy plants

Municipal and industrial waste

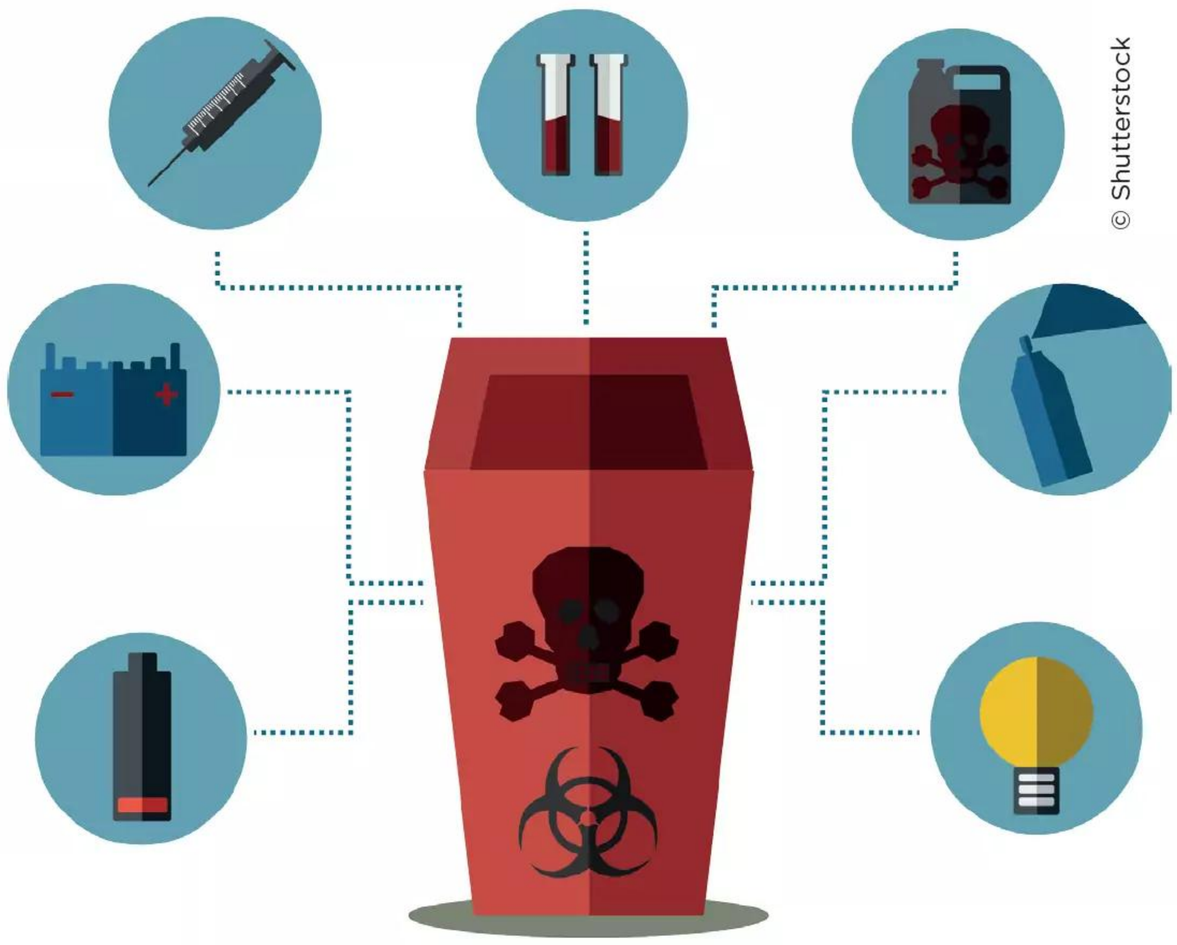
DIFFERENT TYPES OF WASTE

Every time people throw things away, **waste** is produced, such as leftover food, clothes, and old or broken domestic appliances. This type of waste is called **solid**, as it consists of objects, and **municipal**, because it is produced by people in their day-to-day life.

The waste generated by industries and commercial activities, such as stores and restaurants, on the other hand, is called **industrial**.

All the waste is collected and taken to **landfills**, which are places where the waste decomposes or is burned. However waste can also be washed and reused in different ways.

The important thing is to make sure it isn't left in the environment to pollute it.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Among others, medicines, batteries, and paints must be disposed of in special containers because they are household hazardous waste (HHW).

Landfills

WHERE DOES WASTE END UP?

All **municipal solid waste**, also known as MSW, that isn't sorted ends up in a landfill. This is an open-air site, usually located on the edge of the city, where waste is accumulated in a hole or piled in a heap. Here, upon contact with the oxygen in the air and the elements—like rain, snow, and sun—waste breaks down into ever-smaller pieces until it dissipates into the environment.

But not all waste disappears at the same rate. Some types **decompose** more quickly, like paper tissues, which take from three to six months. Others take longer: aluminum from a can, for example, can take between ten and a hundred years, while the plastic from a bottle can remain in the ground of the landfill in the form of tiny pieces even after hundreds of years! And during all those years, the plastic pollutes the ground around it, damaging the environment. But that's not all: as the waste in the landfill decomposes over time, it produces carbon dioxide and methane, which are both gases that let less heat leave the planet, thus causing temperature to rise and contributing to climate change.

Waste decomposes at different rates. Glass can take over a thousand years!

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Collecting and recycling

WASTE SORTING

If you live in a country that recycles, it is very important to follow the rules for sorting waste when disposing of it: basically, each material should be put with other similar materials. For example, cans and some other containers, like those used for ground coffee, are made of aluminum and so should be disposed of in the same bin, to be processed together. Sorting the waste by the materials it's made of is the first step in enabling it to be **recycled**.

Recycling works like this: the people who take the waste away, the trash collectors, separate what is in good enough condition to be reused from what isn't. The selected waste is then washed and shredded into small pieces so it can be transformed into something else. When waste is recycled, new objects can be produced using the same materials, therefore wasting less resources.

What's more, recycling helps keep the environment cleaner. The most commonly recycled materials are paper, plastic, aluminum, and glass, but they're not the only ones. Nowadays, some wet waste, such as orange and apple peels, can also be treated to produce sustainable fabrics, which can be used to create clothes, bags, and even shoes.

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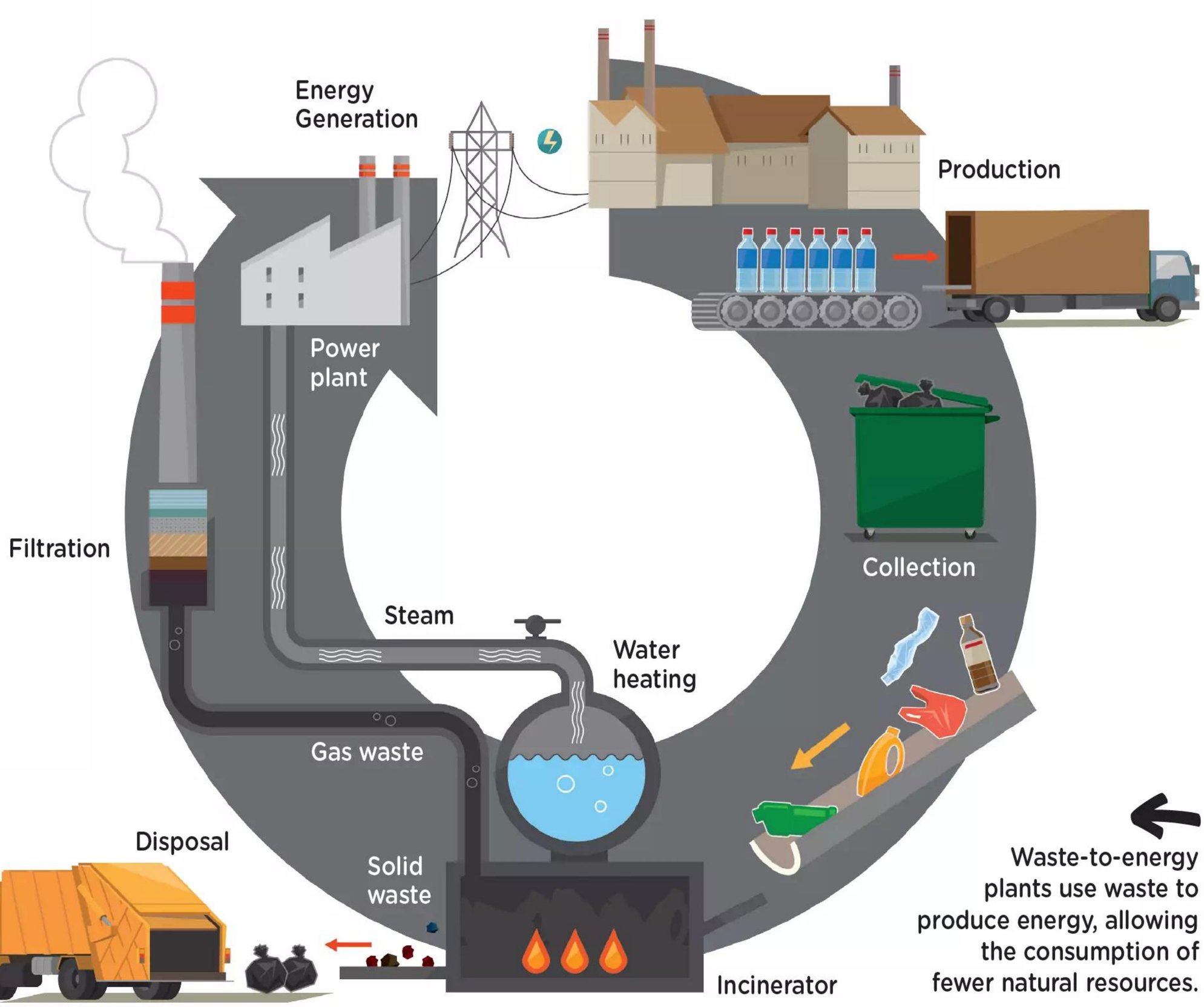
After they've been read, newspapers, books, and so on can be disposed of in special bins ready for recycling. They are then effectively transformed into new paper in specialized factories. And this paper can become a new book or notebook, beginning the cycle again.

Waste-to-energy plants

EVEN WASTE IS USEFUL

Unsorted municipal solid waste may be taken to a landfill, but it can also be burned in a **waste-to-energy plant**, a place where waste is converted into energy for people to use. Here, the waste is tipped into a giant tank, where it is mixed. Then a kind of escalator transports it to a high-temperature furnace called an **incinerator**. While it is being burned, the waste produces fumes that contain pollutants. Because of this, the fumes are treated—meaning they're cleaned so they don't pollute the air—before being released through a chimney.

To improve the process, the waste can be presorted to separate materials that are easily burned from those that aren't. When the waste is burned, it generates a **large amount of heat**, which heats the water contained in special pipes. When the water is hot enough, it turns into **steam**, meaning that it changes from a liquid to a gaseous state. The resulting steam generates electrical energy via a rotating mechanism called a **turbine**, which transforms the movement of a **fluid** (a liquid or a gas) into energy. Furthermore, it is increasingly common for part of this steam to be sent directly to houses' heating systems as ready-to-use thermal energy!



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Waste-to-energy plants use waste to produce energy, allowing the consumption of fewer natural resources.

DON'T LOSE YOUR BOTTLE!

The trash collectors have just taken your bottle along with my stuff!

Oh, no! We have to get it back!

Too late! It's already left!

VROOOOM

There goes our only possible clue as to where last night's truck came from!

It's not over yet, Carrots!

You! I bet you know where the garbage truck's going, don't you?

Well, to the **waste collection** center, of course!

And where is it?

Just outta town. It's not far...

Gideon, we have a favor to ask you...

Yahoo! Come on, Nick, we've almost caught up!

Pant! It's that "almost" that worries me! I don't know how much longer I can keep this speed up.

WHIRRRRR

C'mon, you can do it! Imagine you're on bike patrol!

Pant, pant! Easy for you to say! **You're** not the one pedaling!

Not much longer, Nick! We're here!

ECO CENTER

Puff! About time! Now we can get the bottle back.

Maybe it won't be as easy as we thought!

It's gonna be like looking for a needle in a haystack!

We can do it!

You think?

Mmmh, that's **household appliances**...

Household appliances

That's scrap **iron**...

Iron

Solvents and paints here!

Solvents, Paints

Batteries and car batteries over here!

Batteries

And **wood** in these two!

Wood

Car batteries

Puff
There's everything except glass!

Refrigerators and Air conditioners

Of course there is, dear! This is where **special waste** is brought, things that aren't thrown away every day!

Such as bulky things, **like this!**

Although that doesn't mean it'll be destroyed!

Yeah, we've become very progressive here in Bunnyburrow!

There's a chance the couch could be taken apart to recover anything that's still useful.

Or, if it's judged to be in good condition, it could be given to someone to be restored and made reusable!

!

No more waste around here! It's the **circular economy!**

Of course!

NIICK!

This is the **eco center**, where the household waste, both hazardous and bulky, is brought!

Huh?

You see? Gideon's oil is here, for example...

USED OIL

Not our bottle, though!

Yeah, 'cause it **ended up** at the **recycling center** over there!

You mean we're in the wrong place?

That's exactly what I mean!

Mmmh, in fact, I see our garbage truck.

Which is about to empty its load! After that, the glass will be taken elsewhere to be **cleaned, broken up and melted,** and **recycled** into new bottles!

There isn't a moment to lose!

Hey, over there! **WAIT!**

RRRONNK

Hey, Sam, there's a couple of folks coming in.

Well, if they want to add some glass, they're welcome to.

After I've emptied the truck, of course!

CLINK CLINKLE TINGLE TLING

NO! STOOOP!

BRROOOOOOMMM KUNKLANKLINK

My bottle!

SMASSSHH

KATAKLANG

Too late!

TINKLE KRINKLE CRASSH KLANG

But the following day it's already time to go back to Zootopia...

Come back soon, Judy!

Bye-bye, Judy!

You too, Nick!

Safe trip, Judy!

And mind you don't get into trouble.

Hey, it won't be easy, but we'll try!

Mom, Dad... I promise I'll find out who's poisoning Bunnyburrow's river!

And how d'you plan to do that, Carrots?

One way or another, Nick, **we'll do it!**

CONTINUES ON PAGE 63

RECYCLING CENTERS AND REDUCING WASTE

- Recycling centers
- Recovering objects
- Packaging or no packaging?

Recycling centers

A NEW LIFE!

Trash collectors take the sorted waste to places called **recycling centers**. Citizens can also take certain types of waste there, for example, objects that are too large for the household garbage or hazardous ones. At the recycling centers, the waste is separated and then sent to materials recovery facilities, where it is washed and recycled. This enables the waste to have a second life and be transformed into something else. For example, truck tarps—the waterproof sheets that are used to cover loads on trucks—seat belts, and movie billboard posters can be turned into bags. This allows less waste to be produced, keeping the environment cleaner and healthier.

Recycled car tires can even be used to make sandals!

Recovering objects

REDUCE, REUSE, AND RECYCLE

Since many more people live in urban areas nowadays, the quantity and variety of waste these areas produce is increasing. As such, it's important to preserve natural resources and protect the environment by following three simple rules: reduce, reuse, and recycle. First of all, it is important to **reduce** the amount of waste produced, meaning the quantity of objects and food that ends up in the garbage each day. For example, we can drink water from the tap instead of buying it in plastic bottles, or take a fabric bag when we go shopping so there's no need to buy plastic ones at the store. It is also important to **reuse** everything we can: from bottles that can be refilled multiple times to old clothes that can become rags for cleaning. Finally, **recycling** sorted materials means being able to use them again to produce other objects. For example, magazine or newspaper pages can be processed and the paper reused to produce notebooks. And that's not all: a sweatshirt can be made by recycling between 10 and 15 plastic bottles!

An effective way of reusing objects takes place at swap parties, where people exchange clothes, books, toys, and other objects.

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HOW TO RECOVER OBJECTS

What does recovering an object mean? It means that instead of discarding it and replacing it with a new one, we try to repair it so it can be used again. Or when objects are no longer in good enough condition to be used, they can be kept and used in different ways. For example, shoes that we've grown out of can be used as flower pots, while a can of beans can be emptied, washed, and painted to make a penholder. With a little imagination, the possibilities are endless!

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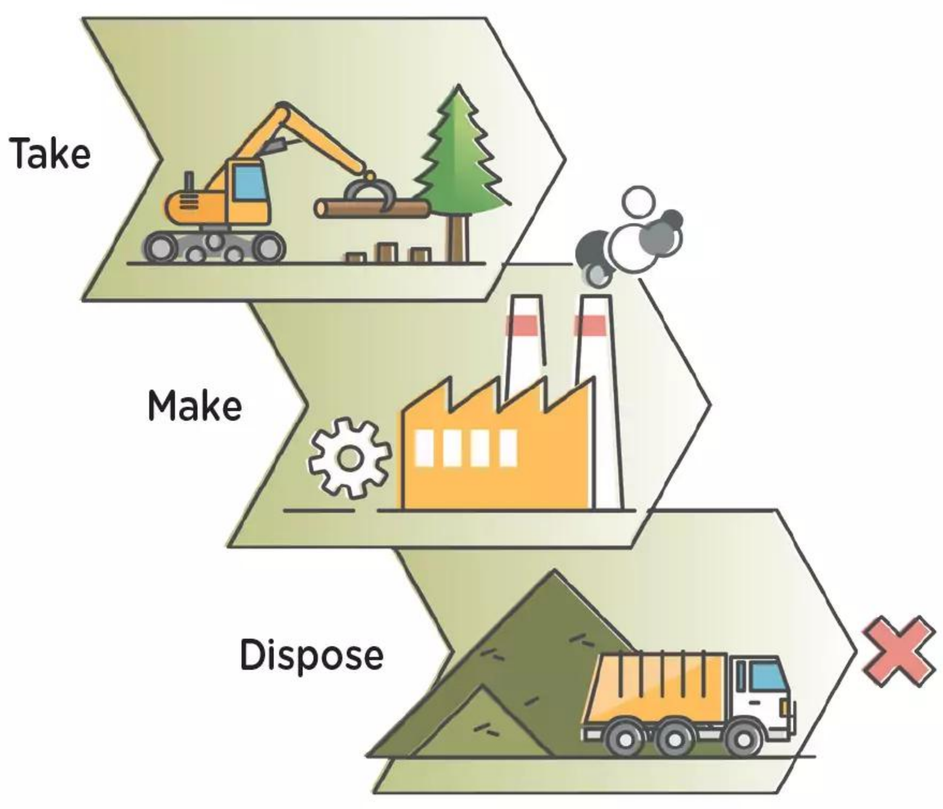
At restart parties, experienced people help repair objects that are broken or don't work properly.

WHY RECOVER?

Recovering objects allows them to be used for longer. And then, when objects can no longer be repaired, they can be sorted and recycled, that is, transformed to be used again. This is called a **circular economy** because it is as though the object stays within a loop: it is created, used, and reused, and then, after use, recovered or recycled so the process can start all over again. This allows an object to be used for as long as possible. For example, certain organic waste, like fruit peels or vegetable scraps, can be used to make compost, a natural substance used to make the soil more fertile. And new fruit and vegetables can be grown on that soil. Circular economy practices can be undertaken by anyone anywhere, even at home.

Unlike the linear economy, where objects are used and then thrown away, the circular economy is based on reuse or recycling.

Linear economy



Circular economy

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Packaging or no packaging?

THE PROBLEM WITH PACKAGING

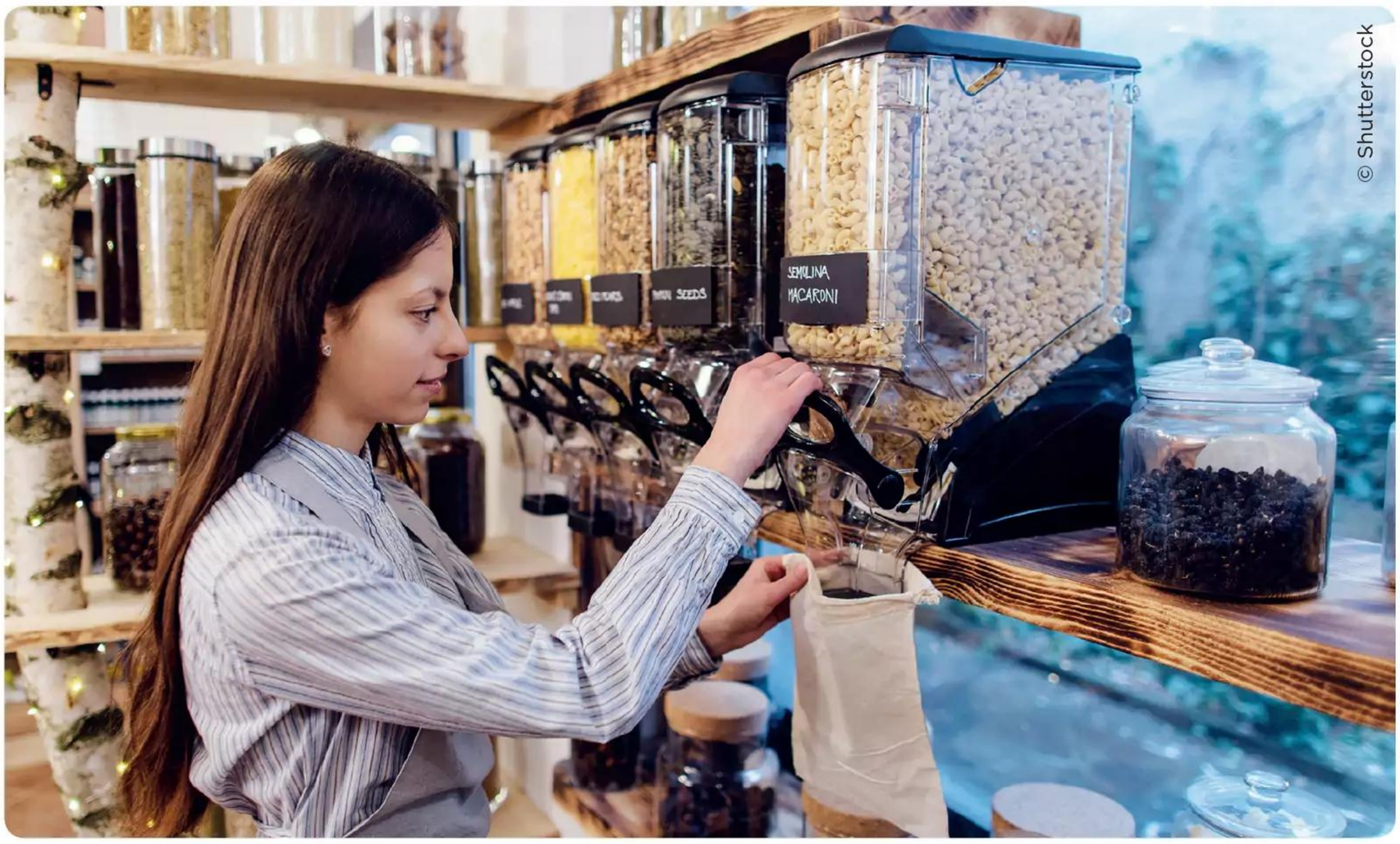
Packaging is the way a product is packed and preserved in order to reach the consumer. It is important because it ensures that the product doesn't get damaged and dirty. Packaging can consist of various materials, with paper and plastic the most widely used. Once the package has been opened though, the packaging becomes waste to dispose of.

Over time, the amount of packaging used **has increased**, causing tons of garbage to be produced every year, but luckily, the number of people who separate waste is also growing, so the recycling of paper and plastic is growing as well! Even though we're still far from balancing out the waste we produce, the rates for recycling these materials are constantly increasing. This is also due to the growing sensitivity of producers, who are creating lightweight packaging that can be easily recycled or reused.

THE SOLUTION ON TAP

Decades ago, products in stores were sold **loose**, meaning they weren't packaged. But since the arrival of supermarkets, loose products have been replaced by packaged ones. And so packaging waste has increased. Luckily, loose products are now available again and sometimes they're described as **on tap**.

At the store, you buy the amount of what you want—rice, for example—and put it in a container to take home. Once you've finished the rice, you go back to buy more using the same container or, if you don't want any more, you leave the container at the store for other shoppers to use. It's an excellent way to reduce waste, taking only the amount you need and using the same container several times.



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Loose products are often grown or prepared near the stores that sell them. In this way, they don't need to be transported for long distances via air, road, or rail, making them more environmentally friendly.